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Differential and combined impacts of extreme temperatures and air pollution on human mortality in south-central Canada. Part I: Historical analysis

Author(s): Cheng C, Campbell M, Li Q, Li G, Auld H, Day N, Pengelly D, Gingrich S,

Klaassen J, MacIver D, Comer N, Mao Y, Thompson W, Lin H

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Abstract:

This paper forms the first part of an introduction to a synoptic weather typing approach to assess differential and combined impacts of extreme temperatures and air pollution on human mortality in south-central Canada, focusing on historical analysis (a companion paper—Part II focusing on future estimates). In this study, an automated synoptic weather typing procedure was used to identify weather types that have a marked association with high air pollution levels and temperature extremes, and facilitates assessments of the differential and combined health impacts of extreme temperatures and air pollution. Annual mean elevated mortality (when daily mortality exceeds the baseline) associated with extreme temperatures and acute exposures to air pollution, based on 1954-2000, was 1,082 [95% confidence interval (CI) of 1,017–1,147] for Montreal, 1,047 (CI 994–1,100) for Toronto, 462 (CI 438–486) for Ottawa, and 327 (CI 311–343) for Windsor. Of this annual mean elevated mortality, extreme temperatures are usually associated with roughly 20%, while air pollution is associated with the remaining 80%. Three pollutants (ozone, sulfur dioxide, and nitrogen dioxide) are associated with approximately 75% of total air pollution-related mortality across the study area. The remaining 25% is almost evenly associated with suspended particles and carbon monoxide, the other two pollutants addressed in this study. Of the five pollutants, ozone is most significantly associated with elevated mortality, making up one-third of the total air pollution-related mortality. PM 2.5 and PM 10 were not used as a measure of particulate in the study due to brief data records. The study results also suggest that, on the basis of daily mortality risks, extreme temperature-related weather presents a much greater risk to human health during heat waves and cold spells than air pollution. For example, in Montreal and Toronto, daily mean elevated mortality counts within the hottest weather type were twice as high as those within air pollution-related weather types.

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Resource Description

Exposure: M

weather or climate related pathway by which climate change affects health

Air Pollution, Meteorological Factors, Meteorological Factors, Temperature, Other Exposure

Air Pollution: Interaction with Temperature, Ozone, Particulate Matter, Other Air Pollution

Air Pollution (other): SO2;NO2;CO

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Temperature: Extreme Heat, Fluctuations

Other Exposure: dew point; cloud cover

Geographic Feature: **☑**

resource focuses on specific type of geography

Urban

Geographic Location: **№**

resource focuses on specific location

Non-United States

Non-United States: Non-U.S. North America

Health Impact: M

specification of health effect or disease related to climate change exposure

Morbidity/Mortality

Resource Type: **☑**

format or standard characteristic of resource

Research Article

Timescale: M

time period studied

Time Scale Unspecified